

Source : Nortel Networks

Object : Mobility in substates of the connected mode

1 Introduction

When looking into the document S2.03, some cases of RRC connection mobility procedures are still opened. This document intends to propose solutions for the cases which have been left for further study and proposes some changes for the S2.03 document.

2 Description

Document S2.04 specifies the UE procedures which have to be supported in Idle mode. The Idle mode is described as a mode where no RRC connection exists between the UE and the Network. In this mode, the UE mobility is performed through cell reselection, and therefore UE controlled. The procedure described in the S2.04 is that UE-AS finds some suitable cells for reselection, mainly based on radio criteria, and UE-NAS actually makes the decision, based on e.g. service criteria.

The 2 chapters below study some substates of the Connected mode having certain commonalities with the Idle mode.

2.1 no logical DCCH / mobility is UE controlled

In Connected mode, a RRC connection has been established between the UE and the Network and logical DCCH resources is usually available for the transfer of signalling. Meanwhile, there are some substates of the connected mode such as the PCH state and the URA connected state where no logical DCCH is available.

In both of those states, the UE location is known with a certain accuracy (cell level or URA level) and the UE only listen to the PCH, and also to the BCH. A RRC connection has been established but is quite "inactive", meaning that no RRC messages either uplink or downlink (except paging and notifications, also applicable to the Idle mode) may be exchanged between the UE and the Network.

This mode looks very similar to the Idle mode. The only differences that we may identify so far are the following:

- there is no RRC connection (or RRC context available) in Idle mode
- the UE location is less accurate than in Idle mode

Therefore, it is proposed that the mobility procedures which apply to the Idle mode (i.e. cell reselection) are also applicable to the following states:

- PCH substate
- URA connected state

2.2 logical DCCH / mobility is UE controlled

This case is slightly different from the previous one, since a DCCH logical channel is available which may be either the RACH or the FAUSCH. This applies to the following substates of the cell connected state:

- RACH/DSCH
- RACH+FAUSCH/DSCH
- RACH/FACH
- RACH+FAUSCH/FACH

Only low traffic level is expected in such state in either downlink or uplink directions. Therefore, it is proposed that the mobility procedures are controlled by the UE, through the "cell update" RRC procedure.

3 Proposed changes to S2.03:

It is proposed to update the following chapters of the S2.03.

4 General Description of Connected Mode

The connected mode is entered when the RRC connection is established. The UE is assigned a radio network temporary identity (RNTI) to be used as UE identity on common transport channels.

The UE leaves the connected mode and returns to idle mode when the RRC connection is released or at RRC connection failure.

Within connected mode the level of UE connection to UTRAN is determined by the quality of service requirements of the active radio access bearers and the characteristics of the traffic on those bearers.

The UE-UTRAN interface is designed to support a large number of UE:s using packet data services. Due to limitations, such as air interface capacity, UE power consumption and network h/w availability, the dedicated resources cannot be allocated to all of the packet service users at all times.

The UE state in the connected mode defines the level of activity associated to the UE. The key parameters of each state are the required activity and resources within the state and the required signalling prior to the data transmission. The state of the UE shall at least be dependent on the application requirement and the period of inactivity.

Packet Services can be supported also using the FAUSCH, by means of which a dedicated transport channel can be allocated for data transmission.

[Editor's note: The FAUSCH transport channel is still under discussion in the L1 Expert Group. If the corresponding physical channel is not approved, then the FAUSCH Transport Channel will be removed]

The different levels of UE connection to UTRAN are listed below:

- No signalling connection exists
The UE is in idle mode and has no relation to UTRAN, only to CN. For data transfer, a signalling connection has to be established.
- Signalling connection exists
When at least one signalling connection exists, the UE is in connected mode and there is normally an RRC connection between UE and UTRAN. The UE position can be known on different levels:
 - UTRAN Registration Area (URA) level
The UE position is known on URA level. The URA is a set of cells
 - Cell level
The UE position is known on cell level. Different transport channel types can be used for data transfer:
 - Common transport channels (RACH/FACH)
 - Dedicated transport channels (DCH) (FAUSCH can be used to allocate a dedicated transport channel for data transmission.)

Assuming that there exists an RRC connection, there are two basic families of RRC connection mobility procedures, ~~URA updating and handover~~. ~~Different families of RRC connection mobility procedures are used in different levels of UE connection (cell level and URA level):~~ UE location updating procedures and handover procedures

- ~~URA updating is a family of procedures that updates the UTRAN registration are of a UE when an RRC connection exists and the position of the UE is known on URA level in the UTRAN.~~
- UE location updating procedures are used in the states for which a RRC connection exists between the UE and the Network, and no DCCH logical channel is available. The UE change of geographical location is indicated to the network through "update" procedures. In such a case, the UE position is known at a URA or cell level.
- Handover is a family of procedures that include procedures for addition or removal of radio links between UE and UTRAN. These procedures may be network controlled or UE controlled (e.g. forward handover). ~~adds or removes one or several radio links between one UE and UTRAN. Those procedures apply when an RRC connection exists and the position of the UE is known on cell level in the UTRAN.~~

4.1.1.1.1

4.1.1.1.2 RRC Connection mobility tasks (PCH)

In the PCH substate, the UE mobility is performed through cell reselection procedures as defined in document S2.04.

Cell updating is initiated by the UE which, upon the detection of the new cell, moves to RACH/FACH substate and initiates a cell update procedure in the new cell. After the cell update procedure has been performed, the UE state is changed back to PCH substate if neither the UE nor the network has any more data to transmit.

4.1.1.2 RRC Connection mobility tasks (URA Connected)

In URA Connected State the location of a UE is known on UTRAN Registration area level. ~~The URA contains a set of cells. The mobility in this state is handled by URA updating procedures.~~

In this state, the UE mobility is performed through cell reselection procedures as defined in document S2.04. ~~URA updating is initiated by the UE which, upon the detection of the new URA,~~ If the new cell belongs to a different URA, the UE moves to RACH/FACH substate of the cell connected state and initiates a URA update towards the network. After the URA update procedure has been performed, the UE state is changed back to URA connected state if neither the UE nor the network has any more data to transmit.